

Transformation of Bauxite Residue into a Reactive Supplementary Cementitious Material

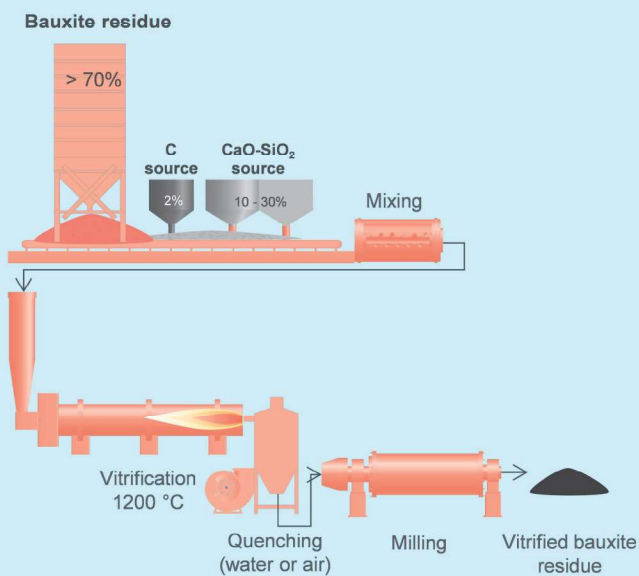
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Introduction

Bauxite residue



- Only 2 – 3% valorised
- > 150 MT/y produced, 4GT stored
- Unsuitable as supplementary cementitious material (SCM)
- ➔ Vitrification bauxite residue

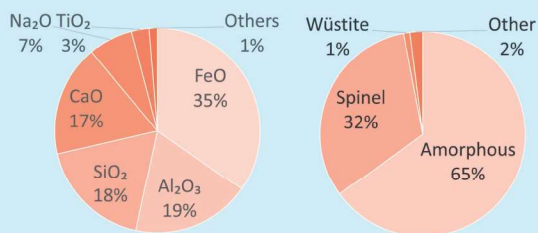


Objectives

- Investigate reactivity and hydration products of vitrified bauxite residue (VBR)

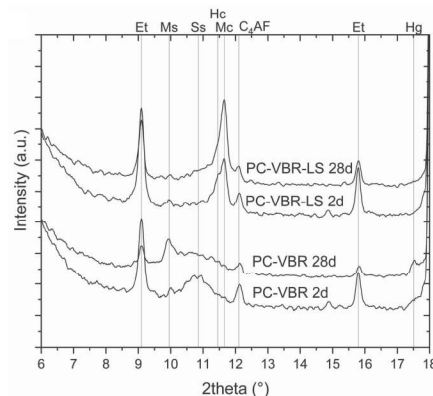
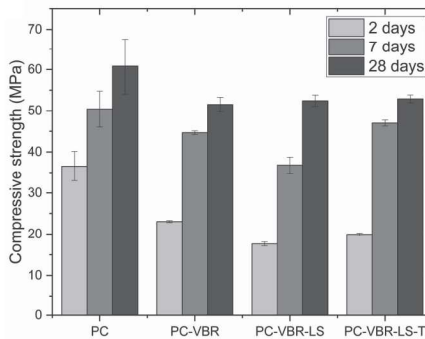
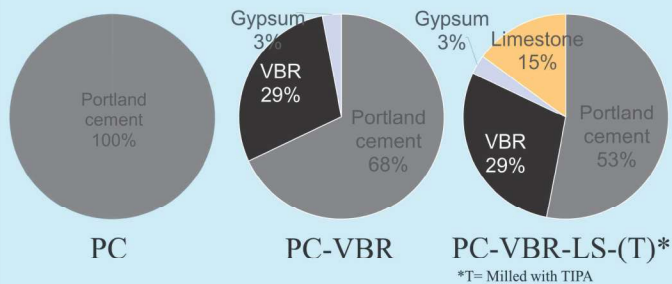
Results and discussion

- Chemical and mineralogical composition VBR



Results and discussion

- Mix design



Mortars (EN 196-1)

Limestone addition

- ↑ 28 d strength

Grinding aid TIPA

- ↑ 7 d strength
- Increased dissolution rate and AFm formation

X-ray diffraction pastes

Limestone addition

- Stabilisation of ettringite (Et) + formation of hemi-carboaluminate (Hc) and mono-carboaluminate (Mc)

Ettringite (Et), monosulfoaluminate (Ms), (carbonated) hemi-carboaluminate (Hc), monocarboaluminate (Mc), AFm solid solution (Ss), Silicious hydrogarnet (Hg)

Conclusions

- VBR is a highly reactive SCM,
- VBR and limestone showed a synergistic effect in ternary mixes on the formation of carboaluminates and the stabilization of ettringite in the binder.
- Use of grinding aid TIPA boost 7 d strength

Outlook

- Interest of industry, upscaling of process ongoing